FOREST RESEARCH DIGEST

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SEVENTEENTH CENTURY ITALIANS UNDERSTOOD FOREST-STREAMFLOW RELATIONSHIPS

The Experiment Station recently received an extremely interesting document from the Milizia Nazionale Forestale, an Italian organization corresponding somewhat to our own C.C.C. This document, which is a reproduction of a Venetian law of 1600, sets up regulations for handling rough lands so as to prevent erosion and for restoring denuded slopes and erosion-wracked streams to normal conditions. A unique part of the law is a series of colored illustrations showing how individual trees look after burning; how a mountain side looks in its original condition, in various stages of destructive agricultural development, including clear cutting of the timber and burning, and again after measures have been taken to restore the original conditions; how the Piave River looked in various stages of development including its restoration to useful condition by erosion control at the headwaters and the use of wing dams in the main channel - all of which indicate that these early seventeenth century Venetians had an unusually clear understanding of forest-streamflow relationships.

RECENT RESULTS FROM SEED DORMANCY TESTS

For some time, physiologists have recognized two general classes of hereditary seed dormancy. In the first class are placed those seeds which have a so-called "dormant" embryo. This includes all seeds which have an immature embryo when separated from the parent plant, as well as seeds whose embryos must undergo certain internal changes before germination may occur (after-ripening). Secondly, there are seeds which possess coats impermeable to water and oxygen or are so thick and firm they prevent the expansion of the embryo. There are, of course, other seeds which have both dormant embryos and impermeable coats, and still others with neither of these characteristics.

In approaching any study of pre-treatments to hasten the germination of seeds, it is first necessary to determine the type of dormancy possessed by the seeds under consideration. This can be accomplished by two tests: 1. Samples of seeds are weighed out and placed in petri dishes between layers of moist filter paper. The dishes are then placed in an incubator and kept at room temperature (20 to 25° C). The absorption of water is determined by weighing the seeds at three-day intervals for about two weeks. Seeds which readily absorb moisture should require no seed coat treatment to prepare them for germination. 2. The second test is for the determination of embryo dormancy. The seed coat is removed and the bare seed is placed in distilled water through which a stream of air is continuously bubbled. If the embryos start growing, it is assumed that no dormancy exists.

To hasten germination the usual treatments for seeds with hard, impermeable coats have included concentrated sulphuric acid, scarification, freezing and thawing temperatures, and soaking in hot water. Storage and placing under optimum conditions for after-ripening are the treatments used for seeds with dormant embryos.

In connection with the work on the Great Plains Shelterbelt project, the type of dormancy of many of the species to be planted was not known. The results of recent tests made at this Station are given below. Experiments are still being conducted but these data are sufficiently complete to give definite indications as to the proper classification of the species.

CLASS OF DORMANCY

Shelterbelt Species	Dormant Embryo	Impermeable Seed Coat	Both	Neither
Acer negundo	x			
Bumelia sp.				x
Catalpa sp.				x
Celtis reticulata		x		
Chilopsis linearis				x
Crataegus sp.		x		
Elaeagnus angustifolia		x		
Fraxinus pennsylvanica	x			
Gleditsia triacanthos		x		
Gymnocladus dioicus		x		
Juglans nigra		x		
Juglans rupestris		x		
Juniperus scopulorum		x		
Juniperus virginiana		x		
Morus alba tartarica			x	
Picea glauca albertiana				x
Picea pungens				x
Pinus austriaca				x
Pinus ponderosa				x
Prunus virginiana			x	
Prunus nigra			x	
Quercus macrocarpa				x
Rhus glabra			x	
Robinia pseudoacacia		x		
Sapindus drummondii		x		
Shepherdia argentea		x		
Sorbus sp.	x			
Toxylon pomiferum	x			
Ulmus pumila				x
Regional Species				
Abies balsamea	x			
Larix laricina				x
Picea excelsa	x			
Picea glauca	x			
Picea mariana				x
Pinus banksiana				x
Pinus resinosa				x
Pinus strobus	x			
Thuja occidentalis				x
Tsuga canadensis				x

GIRDLING AND POISONING

The Southern Forest Experiment Station has recently completed an examination of a girdling and poisoning experiment. Over 1700 hardwoods from 4 to 23 inches D.B.H. were treated by one of three methods: 1. girdling, 2. girdling and poisoning, 3. hacking and poisoning.

The recent examination showed that simple girdling without poisoning is practically as efficient in killing the trees as girdling and poisoning. The mortality of the girdled trees was 98.4 per cent, and 99.8 per cent of the girdled and poisoned trees died. A large proportion of the trees poisoned only in isolated axe hacks were still alive at the end of five years. The poison in the latter case failed to spread laterally from the hacks and only the wood in the vicinity of the hack was killed. It appears that poisoning is an unnecessary addition to the work of girdling and simply adds to the expense of the work.

EFFECT OF SOIL TEMPERATURE ON GROWTH OF THINNED STANDS

A short article by George S. Perry* indicates that soil temperature may be a factor limiting the growth of mature trees of certain species when occurring near the northern limit of their range. The author quotes results from northern Sweden, where it was found that very heavy thinning in dense, stagnated stands of spruce produced very remarkable growth of the remaining trees. Not only were these stands thinned but the dense low undergrowth was also cut out so that the sun was able to warm the soil.

In Pennsylvania shortleaf pine reaches its northern limit but it still forms very good stands which grow well in early life. However, the growth rate slows down later. It was thought that the closing of the crowns in these stands might result in such unfavorable soil temperature conditions that growth would be affected adversely. Two plots were laid out in a good, 49-year-old stand. One was moderately thinned and all the understory hardwoods were cut back to the ground. During the first five years following treatment the thinned and cleared stand grew at the rate of 121 cubic feet per year while the untreated stand averaged only 42 cubic feet per year. Board foot growths showed the same result, 476 board feet per year on the treated compared with 168 on the untreated.

It is probable that this treatment will not always be beneficial as it has already been established that in certain types an understory of tolerant shrubs or reproduction is very beneficial in protecting the soil, but the above data indicates that in certain cases, opening up the stand so as to expose the soil to the rays of the sun may be a very advantageous operation.

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* George S. Perry, Management of Shortleaf Pine. Service Letter, Pennsylvania Department of Forests and Waters, February 14, 1935.

TOWARD BETTER SURVIVAL

The Station has been carrying on planting experiments in the sand hills of North Dakota for a number of years, and these are now beginning to show very definite results.

One of the most evident facts is that the planting stock must be well balanced as to tops and roots. Stock having a top-root ratio (by weight) of over 3.25 is almost certain to give poor survival. The limiting ratio will vary considerably with different species and the above figure is only a rough average. Further experimenting must be done before definite figures for each species can be set. Stock grown in commercial nurseries is usually too top-heavy. Transplants grown in Federal nurseries are usually more satisfactory.

The possibility of increasing survival by artificially shading the newly planted seedling is brought out by a preliminary experiment. Shading has been tried out on only a small area so far, but the results show a distinct advantage for the shaded plants. The shading was effected by scattering short limbs of chokecherry brush along the rows of scalps before planting and then piling a double handful of finely broken brush on the south and west side of each tree as soon as it was planted. Shading with brush would not be feasible on heavy-sod land because it would interfere with cultivation and furthermore natural brush is not present on such areas.

The table below shows the quantitative results of the experiment.

1 - 1 - 1 Ponderosa Pine

Treatment	No. of trees planted	Survival per cent first year after planting
Covered with double handful of dead brush as soon as trees were planted	882	68.4
No brush covering. Two rows were left as checks.	533	40.3
No brush cover. About 40 per cent of needles were removed with pocket knife. Theory - To reduce transpiration area.	335	33.5

2 - 1 Scotch Pine

Covered with double handful of dead brush as soon as trees were planted.	537	45.5
No brush covering	356	28.1

A COMPARISON OF SEEDLING AND TRANSPLANT STOCK

Recent results of a planting experiment being carried out by the Station on the Huron National Forest in which 2-0 and 2-1 Norway pine stock were compared after three growing seasons, show significant differences in favor of the transplants.

The trees were planted in alternate rows on four different planting sites in 1931. Measurements at the end of 1934 showed that the average survival percentage of 2-1 stock for all conditions was 23 per cent greater than for the 2-0 stock and that the height growth of the former was .77 inches greater. Both of these values are highly significant statistically. While the differences in survival and height growth were in favor of the transplant stock on all four areas, they were greatest on the poorest site and least on the most favorable site.

Although these results are decidedly of a preliminary nature, they do indicate that on the more difficult planting sites of the Michigan sand plains transplant Norway pine stock may show enough better early growth and survival to justify its use from an economic point of view, instead of the cheaper seedling stock.

HOW MUCH WOOD IN A CORD?

The solid content of cordwood stacks varies with the character of billets, their size and the care of piling. Billets may be straight, crooked, rough or smooth; they may be long or short, peeled or unpeeled. All these factors vary and numerous combinations of them are possible. They control the amount of wood that can be actually piled in the allotted space of 128 cubic feet, considered as a standard cord.

The actual solid content of cordwood piles is far below their full capacity. About 19 cubic feet of air space is lost even in piling perfectly smooth, straight, cylindrical billets. Since most of the billets have uneven taper and therefore cannot be piled in perfect formation, an additional 11 cubic feet are lost in piling. Large, short billets pack better than do long, small ones. Such factors as crookedness, roughness, etc. reduce the solid content of stacks still more. The table shows how the solid content of a standard cord varies with the character and the size of billets.

Although this table does not pretend to be very exact or applicable to every possible condition, its general utility in every-day usage where "by guess and by gosh" rules are still commonly employed, is unquestionable. The application of this table to actual problems is very simple. It requires only the approximate knowledge of how the merchantable cubic-foot volume of the stand or of the entire forest, when cut for cordwood, is distributed in regard to the various specifications of billets shown in the table. Both the classification of the material and the estimate of their relative proportion should be made in a very general way as shown in the accompanying example:

Stand: Northern Hardwoods, Sawtimber size.

Character of billets (8' long)	Proportion Percent	Factor	Product
Small tops and branches	5	50	250
Large butts	35	78	2730
Medium billets, slightly rough and knotty	60	82	4920
Average cordwood converting factor (cu. ft.)			79.00

SOLID CONTENT OF CORDWOOD PILES°

CHARACTER OF BILLETS

Size of Billets	Straight : Smooth		Slightly Rough or Knotty		Not Straight : Slightly Crooked and Rough		Considerably Crooked		Crooked Rough & Knotty		Tops and Branches		Butts	
Inches	Length of Billets - Feet													
	8	4	8	4	8	4	8	4	8	4	8	4	8	4
	Cubic Feet per Standard Cord of Wood and Bark													
Softwoods														
Small (3-7)	88	90	80	84	76	80	72	76	65	70	60	67		
Medium (8-14)	93	95	88	91	84	88	80	85	75	79			75	78
Large (15+)	98	100	94	96	91	93	87	90	80	83			84	86
Hardwoods														
Small (3-7)	82	85	73	78	70	75	65	70	60	65	50	58		
Medium (8-14)	88	91	82	85	79	82	75	79	70	75			70	74
Large (15+)	95	98	90	92	86	89	82	85	75	78			78	81

°Billets are piled with the bark on. In order to exclude bark, reduce the table values by 12 cu. ft. for birch, aspen, spruce and balsam fir, 14 cu. ft. for pines, ash and basswood, and 16 cu.ft. for sugar maple and hemlock.

SELECTIVE LOGGING BY LUMBER COMPANIES

The new acquisition policy in force in Region 9 permits the purchase of selectively-logged timberlands, and a number of lumber companies have been interested in selling their lands on this basis. In order that the logging will leave the stand in good condition the Forest Service has been cooperating with the companies to develop marking practices for northern hardwoods, a forest type particularly adapted to this silvicultural system.

A conference was held at Rhinelander, Wisconsin for the purpose of working out the correct principles right in the woods. The Regional office, several national forests, the Experiment Station and the lumber company were represented. The Station has accumulated a good bit of experience in the selective logging of hardwoods as a result of the work at the Upper Peninsula Branch Station. Four ten acre plots were marked for cutting by the men from the acquisition survey. Two of these were re-marked by the Station in accordance with the principles developed from the studies of selective logging.

The timber on the tract in question is very much over-mature and cull will probably run to forty per cent of the gross volume. In such stands it is necessary to cut quite heavily in order to remove as many of the old, decadent trees as possible. In this case about 25 per cent of the stand was left. The lumber company has agreed to cut over the sample marking areas in the near future. Logging cost records will be kept and the material will be followed through the mill to determine cost and value of the product.

THE SEASONAL FOOD HABITS OF THE SNOWSHOE HARE

An examination of the stomachs of 53 Snowshoe hares taken in Minnesota was made by the Biological Survey. Analyses of the foods found in the stomachs brought out the seasonal variations in the diet of these hares.

In spring their food consists of portions of woody plants, grasses and herbaceous material, with the woody plants probably representing the major part. A heavy infestation of nematode worms (Obeliscoides cuniculi) is commonly found in the stomachs.

In the summer, herbaceous plants become the most important item of food and but a small proportion comes from woody plants. There is also a marked reduction in the number of stomachs containing the nematode worms.

During the fall, grasses become the chief food, although a small amount of bark and buds from woody plants is eaten. Practically no worms are found in the stomach at this season.

In winter, when snow covers most of the available ground vegetation, these hares live almost entirely on a diet of bark from woody plants. The nematode worms again begin to show up in relatively small numbers but in most of the stomachs. The presence of fur in the stomachs roughly follows the same trend as the worms. At present little is known as to whether the worms have a beneficial or a damaging effect on the rabbits.